

JC07 Rec'd PCT/PTO 15 MAR 2002

FORM PTO-1390U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE (REV 5-93) TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		ATTORNEY'S DOCKET NUMBER <b>9052-112</b>
INTERNATIONAL APPLICATION NO. <b>PCT/GB00/03547</b>	INTERNATIONAL FILING DATE <b>September 15, 2000</b>	U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5) <b>10/088563</b>
TITLE OF INVENTION <b>SEAL ASSEMBLY</b>		
APPLICANT(S) FOR DO/EO/US <b>Steve Smith</b>		
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:		
<ol style="list-style-type: none"> <li>1. <input checked="" type="checkbox"/> This is a <b>FIRST</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li>2. <input type="checkbox"/> This is a <b>SECOND</b> or <b>SUBSEQUENT</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li>3. <input checked="" type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(l).</li> <li>4. <input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.</li> <li>5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2))             <ol style="list-style-type: none"> <li>a. <input checked="" type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau).</li> <li>b. <input type="checkbox"/> has been transmitted by the International Bureau.</li> <li>c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US).</li> </ol> </li> <li>6. <input type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)).</li> <li>7. <input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))             <ol style="list-style-type: none"> <li>a. <input checked="" type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau).</li> <li>b. <input type="checkbox"/> have been transmitted by the International Bureau.</li> <li>c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.</li> <li>d. <input type="checkbox"/> have not been made and will not be made.</li> </ol> </li> <li>8. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).</li> <li>9. <input type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).</li> <li>10. <input type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).</li> </ol>		
<b>Items 11. to 16. below concern other document(s) or information included:</b>		
<ol style="list-style-type: none"> <li>11. <input type="checkbox"/></li> <li>12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.</li> <li>13. <input checked="" type="checkbox"/> A <b>FIRST</b> preliminary amendment. <input type="checkbox"/> A <b>SECOND</b> or <b>SUBSEQUENT</b> preliminary amendment.</li> <li>14. <input type="checkbox"/> A substitute specification.</li> <li>15. <input type="checkbox"/> A change of power of attorney and/or address letter.</li> <li>16. <input type="checkbox"/> Other items or information:</li> </ol>		

JC10 Rec'd PTO 15 MAR 2002

U.S. APPLICATION NO. (known as) 37 CFR 1.492(e) <b>107088563</b>	INTERNATIONAL APPLICATION NO. PCT/GB00/03547	ATTORNEY'S DOCKET NUMBER 9052-112
17. [ X ] The following fees are submitted:		
<b>Basic National Fee (37 CFR 1.492(a)(1)-(5)):</b> Search Report has been prepared by the EPO or JPO ..... <b>\$1040.00</b>	CALCULATIONS	PTO USE ONLY
International preliminary examination fee paid to USPTO (37 CFR 1.482) ..... <b>\$890.00</b>		
No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) ..... <b>\$710.00</b>		
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... <b>\$100.00</b>		
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) ..... <b>\$100.00</b>		
<b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b>	<b>\$1040.00</b>	
Surcharge of <b>\$130.00</b> for furnishing the oath or declaration later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	\$	
Claims      Number Filed      Number Extra      Rate		
Total Claims <b>28</b> -20 = <b>8</b> X <b>\$18.00</b>	<b>\$144.00</b>	
Independent Claims <b>3</b> -3 = <b>0</b> X <b>\$84.00</b>		
Multiple dependent claim(s) (if applicable)	+ <b>\$280.00</b>	\$
<b>TOTAL OF ABOVE CALCULATIONS =</b>	<b>\$1184.00</b>	
Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28).	\$	
<b>SUBTOTAL =</b>	<b>\$1184.00</b>	
Processing fee of <b>\$130.00</b> for furnishing the English translation later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(f)).	\$	
<b>TOTAL NATIONAL FEE =</b>	<b>\$1184.00</b>	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). <b>\$40.00</b> per property +	\$	
<b>TOTAL FEES ENCLOSED =</b>	<b>\$1,184.00</b>	
	Amount to be refunded	\$
	charged	\$
a. [X] A check in the amount of <b>\$1,184.00</b> to cover the above fees is enclosed.		
b. [ ] Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.		
c. [ X ] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 50-0220.		
<b>NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.</b>		
SEND ALL CORRESPONDENCE TO	"Express Mail" mailing label number <b>EV 01581088345</b> Date of Deposit <b>3/15/02</b>	
James R. Cannon, Esq. Myers Bigel Sibley & Sajovec Post Office Box 37428 Raleigh, North Carolina 27627	I hereby certify that this paper is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. 1.10 on the date indicated above and is addressed to Commissioner for Patents, Washington, D.C. 20231.	
Date: <b>3/15/02</b> Joyce Paoli		
SIGNATURE  James R. Cannon		
35839 REGISTRATION NUMBER		

10/088563

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Attorney's Docket No. 9052-112

PATENT

IN THE UNITED STATES DESIGNATED OFFICE (DO/US)

In re: Application of Steve Smith  
Serial No.: To Be Assigned  
Filed: Concurrently Herewith  
For: *SEAL ASSEMBLY*

Date: March 15, 2002

Commissioner for Patents  
Washington, DC 20231

**Correspondence Address:**



20792

PATENT TRADEMARK OFFICE

**PRELIMINARY AMENDMENT**

Dear Sirs:

Please amend the above-identified application as follows. Please enter the Preliminary Amendment prior to the fee calculation.

**IN THE SPECIFICATION**

Please insert the following paragraph at page 1 after the title:

**--Related Applications**

This application claims priority from PCT Application GB00/03547, filed 15 September 2000, which claims priority from British Application No. 9921791.1, filed 16 Septmeber 1999. These disclosures are hereby incorporated by reference herein in their entireties.--

**IN THE CLAIMS**

Please delete Claim 29.

Please amend the following claims to the form set forth below; changes to the claims from the form set forth in the amended sheets filed with the PCT application are indicated in the attached appendix entitled "**Version Marked to Indicate Changes**".

In re: Application of Steve Smith  
Attorney Docket 9052-112  
Page 2 of 3

10. (amended) A radial sealing ring assembly (8) according to claim 8 characterised in that the apertures or holes are arranged in a regular pattern.

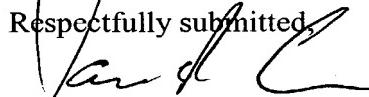
15. (amended) A radial sealing ring assembly (8) according to claim 8 characterised in that the apertures or holes are from 0.5mm to 2.0mm deep.

16. (amended) A radial sealing ring assembly (8) according to claim 8 characterised in that the apertures or holes are preferably substantially the same size and shape.

REMARKS

Applicant respectfully requests consideration of the foregoing amendments, which are made to the application on the presumption that the application is amended to the form indicated on the attached amended sheets submitted by Applicant in connection with the PCT application. The amendments made herein are to eliminate the multiple dependency of certain claims and to claim priority from pending foreign and international applications. Please enter this amendment prior to calculating the fee in this case.

Respectfully submitted

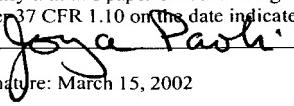
  
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Joyce Paoli  
Date of Signature: March 15, 2002

In re: Application of Steve Smith  
Attorney Docket 9052-112  
Page 3 of 3

**Version Marked to Indicate Changes**

**IN THE SPECIFICATION**

Please insert the following paragraph at page 1 after the title:

**--Related Applications**

This application claims priority from PCT Application GB00/03457, filed 15 September 2000, which claims priority from British Application No. 9921791.1, filed 16 Septmeber 1999. These disclosures are hereby incorporated by reference herein in their entireties.--

**IN THE CLAIMS**

• Please amend the following claims.

11. (amended) A radial sealing ring assembly (8) according to [claims 8 or 9] claim 8 characterised in that the apertures or holes are arranged in a regular pattern.

15. (amended) A radial sealing ring assembly (8) according to [claims 8 or 9] claim 8 characterised in that the apertures or holes are from 0.5mm to 2.0mm deep.

16. (amended) A radial sealing ring assembly (8) according to [claims 8 or 9] claim 8 characterised in that the apertures or holes are preferably substantially the same size and shape.

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SEAL ASSEMBLY

This invention relates to a novel seal assembly.

5 Natural gas is commonly transported, in bulk, across land through large diameter (eg 24 inch) steel pipelines. It is not uncommon to introduce offtakes or three way joints at certain points on the main transmission pipeline. Currently, a three way joint is welded into the pipeline, following the removal of a section of pipe. This procedure when carried out with gas loaded into the line is hazardous and expensive, involving  
10 the installation of a secondary "loop" through which to bypass the gas whilst the joint is installed.

We have now found a novel form of seal which is capable of acting as a primary sealing element that can provide a seal between a main transmission line and bonded  
15 branch connection. The seal must withstand service and test pressure including pressure reversals and must also be able to accommodate eccentricity of the branch connection to the main pipeline.

Copending British Patent Application No. 9917 360.1 describes a novel method of  
20 securing a branch assembly to a pipeline. Such a method requires a specialised seal which is not only adapted to operate under significant pressures but can also be fitted to non-planar or arcuate surfaces.

British Patent Application No. 1214986 describes a sealing means for use with a pair  
25 of pipes which are angularly movable relative to each other. Generally, the sealing means comprises an annular body portion and a pair of spaced tongues, the tongues being provided with inwardly inclined ears. However, the seal described therein is designed for use in connection with "parallel" pipeline flange joints. The seal does not provide a solution to the problem of forming a fluid tight seal in a branched  
30 pipeline.

French Patent Application No. 1549562 describes a seal assembly which comprises a pair of circumferential grooves which are adapted to prevent the ingress of fluid.

Thus it is known to use "U" ring seals in pressure systems wherein the pressure acts  
5 on the side wall of the U ring. However, we have now surprisingly found a novel  
seal assembly which is sufficiently flexible so as to be adaptable to fit parallel,  
planar, arcuate or convex surfaces.

Thus according to the invention we provide a radial sealing ring assembly adapted for  
10 use in a pressurised system which comprises a radial sealing ring provided with at  
least a pair of primary sealing lips radially disposed on a first, circumferential, face of  
the ring, a second, axial end face of the radial sealing ring being provided with means  
for dispersing pressurised fluid characterised in that the means for dispersing the  
pressurised fluid is a labyrinth seal located on the axial end face.

15 In a preferred embodiment of the invention the means for dispersing pressurised fluid  
comprises means for dispensing pressure in a circumferential and a radial direction.

20 The seal of the invention is advantageous in that it is especially useful in pressure  
systems since the pressure acts on the walls of the lips and the portion of the seal  
joining the lips to enhance the pressurised fluid seal produced. The seal will  
hereinafter be described as a radial sealing ring.

In conventional land based pipe lines the pressure differential is such that the internal.....  
25 face of the seal experiences greater pressure than the external face. Thus, in such an  
embodiment, the first circumferential face of the seal is the inner face and the second  
circumferential face is the outer face.

30 In a further embodiment of the invention the seal arrangement may be such that the  
external pressure on the seal is greater than the internal pressure. Such seals are, for  
example, advantageous in that they may be suitable for sub-sea pipelines.

In an alternative embodiment of the invention for use in sub-sea applications, it may be necessary to provide means of sealing to prevent the ingress of water which may be (at times) at a higher pressure than the pipeline fluid. In this case a pair of primary 5 sealing lips may be radially disposed from an outer circumferential face of the radial sealing ring, whilst means for dispersing pressurised fluid is provided on the inner axial end face of the radial sealing ring.

The dispersing means may comprise a labyrinth seal, which may be located on the 10 axial end face of the seal. In a preferred embodiment both axial end faces of the radial sealing ring are provided with a pressurised fluid dispersing member, in which case the labyrinth seals may be the same or different.

Labyrinth seals are known to cause reductions in pressure across the axial end face of 15 the seal. Thus, the labyrinth seals used may comprise an array of apertures. Alternatively, the labyrinth seals may only be partially cut through such that the seal comprises a plurality of hollows or holes. The apertures or holes (together referred to as "the bulkheads") may be arranged irregularly or preferably, in a regular pattern. When a regular pattern is used a 'brick-bond' pattern is preferred, that is, the 20 bulkheads are offset in relation to one another. On opposite sides of the seal faces the bulkheads may be circumferentially offset to one another, for example, by half the pitch of the bulkhead. Alternatively, the bulkheads may not necessarily be offset. Although it is within the scope of the present invention for the labyrinth seals to be 25 separate to the radial sealing ring, or to be bonded to the radial sealing ring, it is preferred that the labyrinth seal is an integral part of the radial sealing ring. When the apertures or holes are in a regular pattern they may comprise two or three circumferential rows. Two circumferential rows are preferred.

The thickness of the labyrinth seal may vary, but is preferably from 1 to 5mm, more 30 preferably from 1.0 to 2.5 mm. The dimensions of the apertures or holes may also be varied depending upon, *inter alia*, the pressure which the radial sealing ring is

subjected to, the material of which the seal comprises, etc. However, it is preferred that the apertures or holes have a depth of from 0.5 to 2.0 mm and more preferably from 1.0 to 1.5 mm. For ease of manufacturing the apertures or holes are preferably substantially the same size and shape and may be substantially rectangular with 5 dimensions of from 5 to 10 mm radial width by 15 to 20 mm circumferential length, preferably 8 by 16 mm. When rectangular apertures/holes are used then the longest side is preferably circumferential.

- Any conventionally known materials may be used in the manufacture of the seals of 10 the invention and preferably the labyrinth seal portion comprises the same material as the U ring portion of the radial sealing ring. Such materials include elastomers and/or plastics. Examples of elastomers include, but are not limited to rubbers, e.g. natural or synthetic rubbers. Of these synthetic rubbers are preferred such as nitrile rubbers, eg acrylonitrile butadiene copolymer (NBR), hydrogenated acrylonitrile 15 butadiene rubber (HNBR), fluoroelastomers (FKM), such as Viton or perfluoroelastomers (FFKM), such as Kalrez. (Viton® and Kalrez® are available from Du Pont Dow Elastomers). Examples of plastics materials include fluorinated polymers such as PTFE (polytetrafluoroethylene).
- 20 The hardness of the elastomer, e.g. HNBR, may be varied. However, it is preferred that the hardness lies in the range of from 50 to 95 degrees Shore A.

The pressure which the seals of the invention are designed to tolerate may be up 105 to 110 bar under test conditions and from 20 to 70 bar under conventional operating 25 conditions. Moreover the seals of the invention may withstand external pressures of up to 350 bar, e.g. from 20 to 350, preferably from 70 to 300, more preferably from 105 to 180 bar.

Under operating conditions there may be a risk of circumferential extrusion between 30 the outer portion of the seal and the pipes. Thus, in a preferred embodiment a

support ring is provided around the outer circumference of the seal eg a coiled spring. The spring is preferentially a metal spring eg a steel spring.

Furthermore, since the radial sealing ring assembly is free to continually expand in a  
5 radial direction under the working pressure acting on the lips of the seal. Thus, in a preferred embodiment of the invention the radial sealing ring may be provided with a containment ring. Such a containment ring preferentially comprises a metal ring situated on the non-pressure facing surface of the seal. The containment ring may optionally be integral to the seal ring or may be separate.

10

Thus in land based pipelines the containment ring is preferentially on the outer surface of the radial sealing ring. However, for use in connection with sub-sea pipelines, the containment ring is preferentially on the inner surface of the radial sealing ring.

15

In systems where the pressure differential across the radial sealing ring may be variable and/or in sub-sea applications a plurality of radial sealing rings of the invention may be used. For example, an outermost radial sealing ring may comprise a radial sealing ring with outer facing sealing lips and an innermost radial sealing  
20 ring may comprise a radial sealing ring with inner facing sealing lips. In such a system the innermost and outermost radial sealing rings may be separate, but may or may not be positioned adjacent to each other.

However, in a yet further embodiment of the invention a radial sealing ring is  
25 provided wherein the seal comprises an innermost radial sealing ring and an outermost radial sealing ring which share a common containment ring.

Thus according to a further feature of the invention we provide a radial sealing ring assembly adapted for use in a prescribed system which comprises a pair of primary  
30 sealing lips radially disposed on an inner circumferential face of the radial sealing ring, the primary and secondary lips being connected by a containment ring member.

In a preferred embodiment of the invention the radial sealing ring is provided with means for dispersing pressurised fluid as hereinbefore described. Further the radial sealing ring assembly as hereinbefore may comprise a single common containment  
5 ring.

The common containment ring may optionally be integral to the radial sealing rings or may be separate.

10 The radial sealing ring assembly of the invention finds utility particularly as large pipeline seals such as may be required in the oil, chemical, water or gas fields. They are capable of sealing surfaces which are parallel; non-parallel, eg by up to 5mm; or, arcuately eccentric, as may be found when a portion of the sidewall of a pipe may be cut away. The radial sealing rings are especially useful in introducing, for example, a  
15 three way joint, into a pipeline by connecting two pipes.

Thus the radial sealing ring assembly may be suitable for use in land based pipelines or sub-sea pipelines.

20 According to a further feature of the invention we provide a method of introducing a three way joint into a pipeline which comprises a hole in a pipe and attaching a second pipe over the hole wherein the radial sealing ring of the invention lies between the two pipes.

25 We further provide a method as hereinbefore described which is suitable for use in a variable pressure system, such as a sub-sea system. Such a method may comprise using a plurality of radial sealing rings of the invention. The method especially comprises using an outermost radial sealing ring which may be provided with outer facing sealing lips and an innermost radial sealing ring which may be provided with  
30 inner facing sealing lips. In such a system the innermost and outermost radial sealing rings may be separate, but may or may not be positioned adjacent to each other.

The invention will now be described by way of example only and with reference to the accompanying drawings in which;

Figure 1 is a perspective view of a segment of a conventionally used U ring;

5 Figure 2 is a perspective view of a segment of a radial U ring seal. Figure 3 is a cross-section of a segment of a radial sealing ring provided with a labyrinth seal of the invention.

Figure 4 is a cross-section of the complete seal of the invention;

Figure 5 is a plan view of the complete seal of the invention;

10 Figure 6 is a cross-section of the seal of the invention for use in sub-sea pipelines; and

Figure 7 is a cross-section of a branched sub-sea pipeline using the seals of the invention; and

Figure 8 is a cross-section of a dual seal assembly.

15

Referring to Figure 1 a conventional U ring seal (which is not of the invention) a seal (1) comprises lips (2 and 3) and lip joining section (4) and a body (5). The body (5) has outer walls (6 and 7). The seal (1) which is shown in segment only, is substantially circular such that the wall (6) is on the inside of the circle and the wall (7) on the outside of the circle.

With reference to Figure 2, a radial U ring seal (8) (which is not of the invention) comprises lips (9 and 10), a lip joining section (11) and a seal body (12). The seal body (12) has axial end faces (13 and 14). The seal (8) is substantially circular such 25 the lips (9 and 10) face inwards towards the centre.

With reference to Figures 3 to 5, a radial sealing ring (8) comprises lips (9 and 10), the seal body (12) of the seal being provided with labyrinth seals (15 and 16) on each axial end face (13 and 14) respectively. The labyrinth seals (15 and 16) are in a 30 "brick-bond" arrangement. The seal body (12) of the radial sealing ring (8) is provided with a support ring (17) in the form of a coiled spring moulded into the seal

body (12). The radial sealing ring (8) is also provided with a containment ring (18) on the second or outer circumferential face which is outermost from the centre.

With reference to Figure 6, a sub-sea radial sealing ring (19) comprises primary sealing lips (20 and 21), the body of the seal being provided with labyrinth seals (not shown) as hereinbefore described. The primary sealing lips (20 and 21) are positioned on the outer facing circumferential surface (22) of the radial sealing ring (19). The body is provided with a support ring (23) and optionally with a containment ring (not shown).

10

With reference to Figure 7, a sub-sea pipeline (24) comprises a main pipe body (25) and a branched pipe (26). The main pipe (25) is provided with an aperture (27) which is coincident with the branched pipe (26). The branched pipe (26) is provided with a flange (28) which overlies the main pipe (25). The gap (29) between the flange (28) and the main pipe body (25) is plugged with radial sealing ring (30) and radial sealing ring (31). Radial sealing ring (30) is provided with inward facing lips (32) which act to prevent leakage from inside the pipeline (24). Radial sealing ring (31) is provided with outward facing lips (33) which act to prevent leakage into the pipeline (24) if the external pressure is greater than the internal pressure.

15

With reference to Figure 8, a radial sealing ring (37) is adapted for use in a variable pressure system. The radial seal ring (34) comprises a pair of inner facing lips (35 and 36) attached to a first seal body portion (37). The seal body (37) is provided with a support ring (38) and a containment ring (39) and the containment ring (39) is adjacent the support ring (38). The containment ring (39) may be integral to the support ring (38), or may be, for example, fixed onto the support ring (38); or may simply be sandwiched into position.

The containment ring (39) has a first face (40) which abuts or is connected to the support ring (38) and a second opposite face (41). The second face (41) is situated

adjacent to a second support ring (42), the support ring (42) being attached to a second seal body (43) which is provided with lips (44 and 45).

Each of the bodies (37 and 43) is provided with labyrinth seals (46, 47, 48, 49) on the  
5 respective axial end faces (50, 51, 52, 53).

10 P36131WO.6

## CLAIMS

1. A radial sealing ring assembly (8) adapted for use in a pressurised system which comprises a radial sealing ring provided with at least a pair of primary sealing lips (9 and 10) radially disposed on a first, circumferential, face (13) of the ring; a second, axial end, face (14) of the radial sealing ring being provided with means for dispersing pressurised fluid characterised in that the means for dispersing the pressurised fluid is a labyrinth seal (15 or 16) located on the axial end face (14).  
5
- 10 2. A radial sealing ring assembly (8) according to claim 1 characterised in that the means for dispersing the pressurised fluid comprises means for dispersing pressure in a circumferential direction.
- 15 3. A radial sealing ring assembly (8) according to claim 2 characterised in that the means for dispersing the pressurised fluid comprises means for dispersing pressure in a circumferential direction and a radial direction.
- 20 4. A radial sealing ring assembly (8) according to claim 1 characterised in that the first circumferential face of the radial sealing ring is the inner face and the second circumferential face is the outer face.  
25
5. A radial sealing ring assembly (8) according to claim 1 characterised in that the radial sealing ring is adapted to be used in a system wherein the external pressure on the radial sealing ring is greater than the internal pressure.  
6. A radial sealing ring assembly (8) according to claim 5 characterised in that the primary sealing lips (9 and 10) are radially disposed from an outer circumferential face of the radial sealing ring, whilst means for dispersing pressurised fluid is provided on the axial end face of the radial sealing ring.  
30

7. A radial sealing ring assembly (8) according to claim 1 characterised in that both axial end faces of the radial sealing ring are provided with a pressurised fluid dispersing means (15 and 16).

5 8. A radial sealing ring assembly (8) according to claim 6 characterised in that the labyrinth seal (15 and 16) comprises a plurality of apertures.

10 9. A radial sealing ring assembly (8) according to claim 6 characterised in that the labyrinth seal (15 and 16) comprises a plurality of holes.

15 10. A radial sealing ring assembly (8) according to claims 8 or 9 characterised in that the apertures or holes are arranged in a regular pattern.

15 11. A radial sealing ring assembly (8) according to claim 10 characterised in that the regular pattern is a 'brick-bond' pattern.

20 12. A radial sealing ring assembly (8) according to claim 1 characterised in that the means for dispersing the pressurised fluid is an integral part of the axial end face of the radial sealing ring.

20 13. A radial sealing ring assembly (8) according to claim 11 characterised in that the apertures or holes are in a regular pattern of two or three circumferential rows.

25 14. A radial sealing ring assembly (8) according to claim 13 characterised in that the apertures or holes are in a regular pattern of two circumferential rows.

15 15. A radial sealing ring assembly (8) according to claims 8 or 9 characterised in that the apertures or holes are from 0.5 to 2.0mm deep.

30 16. A radial sealing ring assembly (8) according to claims 8 or 9 characterised in that the apertures or holes are preferably substantially the same size and shape.

17. A radial sealing ring assembly (8) according to claim 1 characterised in that the assembly is adapted to tolerate from 20 to 70 bar under conventional operating conditions.
- 5 18 A radial sealing ring assembly (8) according to claim 1 characterised in that the radial seal is provided with a containment ring (18).
- 10 19. A radial sealing ring assembly (8) according to claim 1 characterised in that the containment ring (18) is on the second or outer circumferential face of the radial sealing ring.
- 20 20 A radial sealing ring assembly (8) according to claim 1 characterised in that the containment ring (18) is on the first or inner circumferential face of the radial sealing ring.
- 15 21. A radial sealing ring assembly (8) according to claim 20 characterised in that the containment ring (18) comprises a support ring (23) around the second or outer circumferential face of the radial sealing ring.
- 20 22. A radial sealing ring assembly (8) according to claim 1 characterised in that the support ring (23) is preferentially a coiled spring.
- 25 23. A radial sealing ring assembly (8) according to claim 1 characterised in that the seal is provided with a containment ring (18) around the second or outer circumferential face of the radial sealing ring.
- 30 24. A radial sealing assembly (8) which comprises a pair of primary sealing lips (9 and 10), one of the pair radially disposed on a first or inner circumferential face, the second radially disposed on a second or outer circumferential face, of the radial sealing assembly, the primary and secondary lips (14 and 15; and 35 and 36) being connected by a containment ring .

25. A method of introducing a three way joint into a pipeline which comprises a hole in a pipe and attaching a second pipe over the hole wherein the radial sealing ring (8) according to any one of the preceding claims lies between the two pipes.

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26. A method according to claim 25 characterised in that the method comprises using a plurality of radial sealing rings (8) according to claim 1.

27. A method according to claim 26 characterised in that the method comprises  
10 using an outermost radial sealing ring which is provided with outer facing sealing lips and an innermost radial sealing ring which is provided with inner facing sealing lips.

28. A method according to claim 19 characterised in that the innermost and  
15 outermost radial sealing rings are separate.

29. A seal assembly (8) substantially as described with reference to the accompanying examples.

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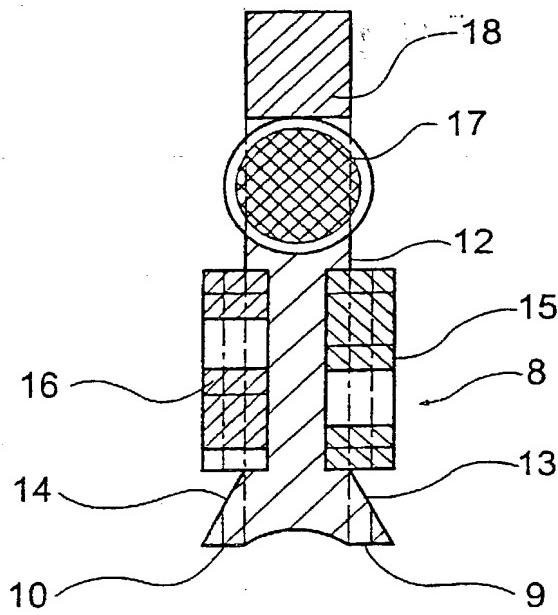
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(54) Title: SEAL ASSEMBLY



(57) Abstract: There is described a seal assembly and a method of sealing parallel, planar, arcuate or convex surfaces. The seal assembly comprises a ring seal provided with a pair of primary sealing lips (9, 10), radially disposed on a first, circumferential face of the ring (8); a second, radial face (13, 14) being provided with means (15, 16) for dispersing pressurised fluid. There is also provided a method of introducing a three way joint into a pipeline.

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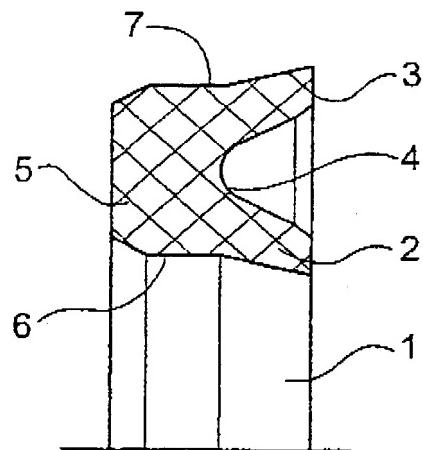


Fig. 1

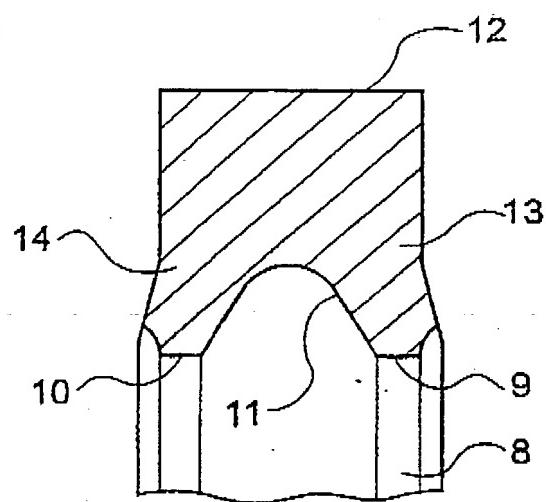


Fig. 2

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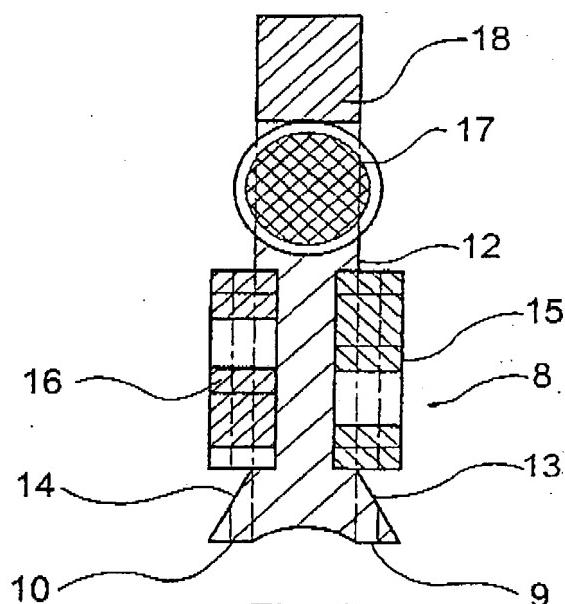


Fig. 3

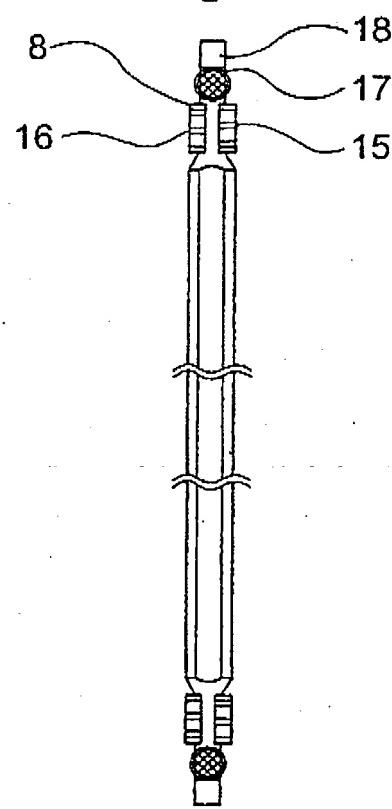


Fig. 4

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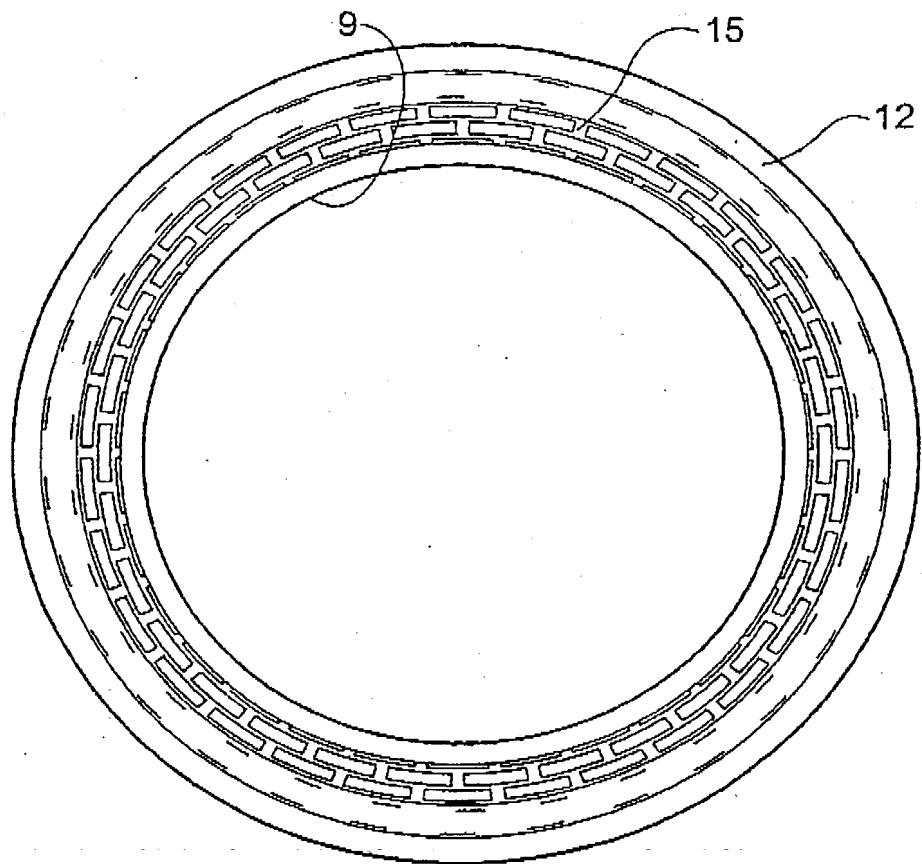


Fig. 5

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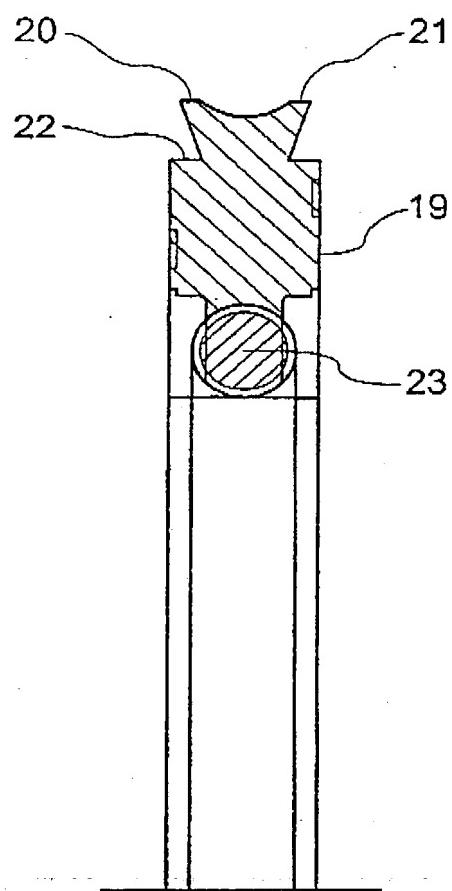


Fig. 6

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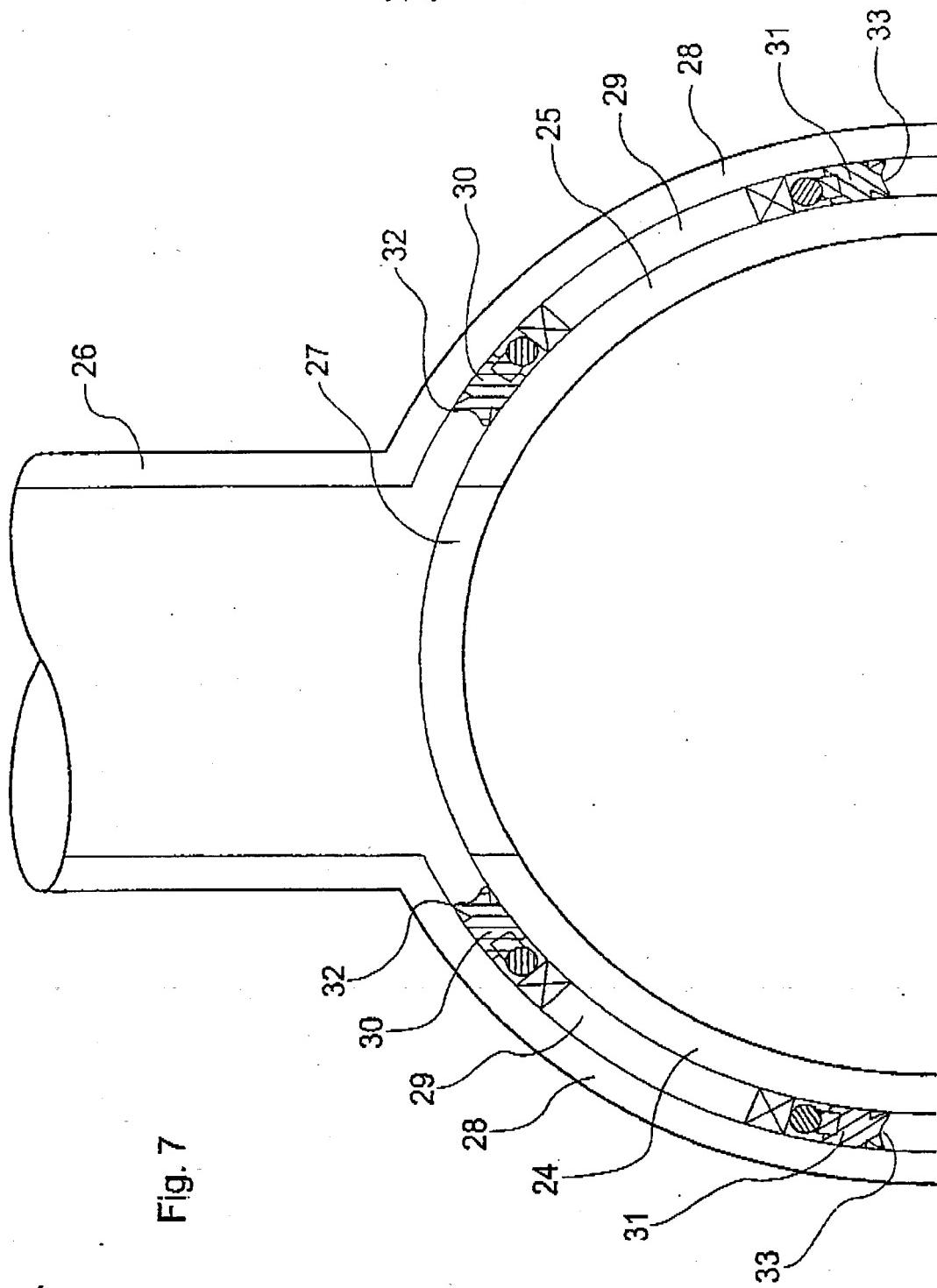


Fig. 7

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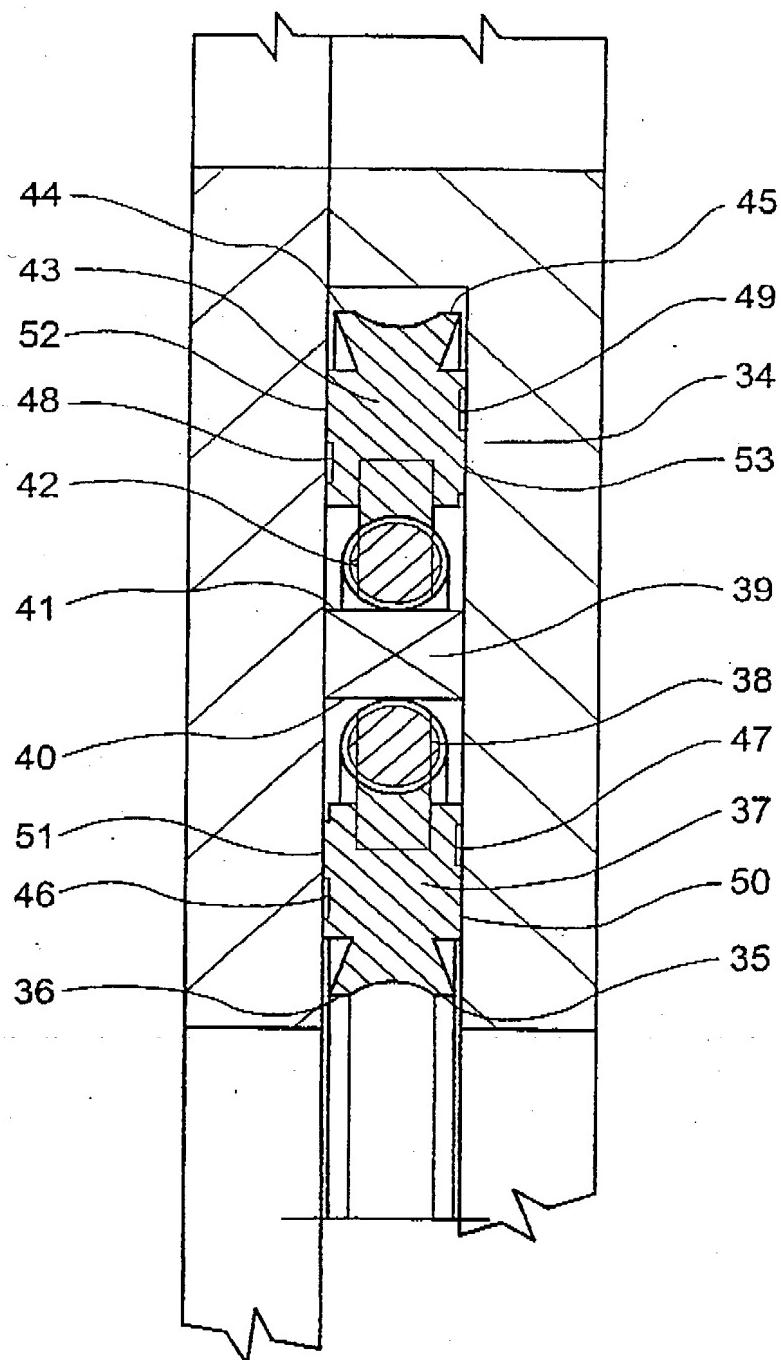


Fig. 8

## Attorney Docket No. 9052.112

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **SEAL ASSEMBLY**

the specification of which

is attached hereto

OR

was filed on March 15, 2002 as United States Application No. 10/088,563 or PCT

International Application Number \_\_\_\_\_ and was amended on \_\_\_\_\_ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37 Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than the United States of America, listed below and have also identified below any foreign application for patent or inventor's certificate, or of any PCT International application having a filing date before that of the application on which priority is claimed.

9921791.1	Great Britain	09/16/1999	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Number	Country	MM/DD/YYYY Filed	Priority Claimed
			<input type="checkbox"/> Yes <input type="checkbox"/> No
Number	Country	MM/DD/YYYY Filed	Priority Claimed

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)
Application Number(s)	Filing Date (MM/DD/YYYY)

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) or § 365(c) of any PCT international application designating the United States of America, listed below.

Appln. Serial No.	Filing Date	Status Patented/Pending/Abandoned

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following registered attorney(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. I also appoint the following registered attorney(s) to represent me before all competent International Authorities in connection with any and all international applications filed by me with an appropriate receiving office claiming priority to the U.S. application. I also appoint the following registered attorney(s) to make or receive payment on my behalf in connection with the filing of such international applications.

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